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an inlet end chamber in communication with a source of fluid;
an annulus in communication with the inlet end chamber, the annulus formed between an outer cylindrical shell and an inner cylindrical shell; and
a plurality of inlet channels in the inlet end chamber, each inlet channel having a wider end closer to the annulus, and a narrower end, wherein adjacent inlet channels are separated by a wall having a substantially uniform thickness.

REMARKS

Applicants' undersigned attorney thanks the Examiner for his comments. Applicants respectfully request reconsideration of this patent application, particularly in view of the above Amendment and the following remarks.

The present invention is directed to a thermal transfer roller having an outer cylindrical shell which contacts a substrate being heated or cooled, an inner cylindrical shell, and an annulus between the inner cylindrical shell and the outer cylindrical shell through which heat transfer fluid may flow. In one embodiment of this invention, the annulus includes a plurality of individual channels as shown in Fig. 3, separated by spiral walls, which carry heat transfer fluid through the annulus from an inlet end of the thermal transfer roller to an outlet end of the thermal transfer roller. In this embodiment, the heat transfer fluid circulates around the annulus in a spiral

flow pattern via the channels as the thermal transfer roller rotates, providing a substantially even fluid supply and distribution through the annulus.

As shown in Fig. 1, the thermal transfer roller may also have a hollow roller journal extending along a central axis of the thermal transfer roller to transfer heat transfer fluid from a second end of the thermal transfer roller to a first end of the thermal transfer roller. The roller journal is in fluidic communication with the annulus.

Amendment to the Claims

Applicants have amended independent Claim 20 to recite that the annulus is formed between an outer cylindrical shell and an inner cylindrical shell. This amendment is fully supported in the specification at page 10, lines 4-8 and in Figs. 1 and 2.

Claim Objections - 37 C.F.R. 1.75

Claims 23 and 25 have been objected to under 37 C.F.R. 1.75 as being a substantial duplicate of Claims 22 and 24 respectively. Applicants respectfully transverse this objection. Dependent Claims 22 and 23 depend from independent Claim 20, whereas dependent Claims 24 and 25 depend from dependent Claim 21. Thus, Claims 24 and 25 are not substantial duplicates of Claims 22 and 23, respectively. Nor are Claims 24 and 25 otherwise so close in content to Claims 22

and 23, respectively, as to cover the same thing. Therefore, Applicants respectfully request withdrawal of this objection.

Claim Rejections - 35 U.S.C. §102

The rejection of Claims 1-4, 8, 9, 14 and 18-21 under 35 U.S.C. §102(b) as being anticipated by Seanor, U.S. Patent 2,783,977, is respectfully traversed, particularly in view of the above Amendment and the following remarks. Applicants' invention as claimed in independent Claims 1, 14 and amended Claim 20 requires an outer shell, an inner shell, and an annulus between the outer shell and the inner shell, wherein the annulus is in communication with an inlet end chamber. Further, the thermal transfer roller as claimed in independent Claims 1 and 14 requires a roller journal. Independent Claims 1 and 14 recite that the roller journal is in communication with the annulus. These novel claim limitations are disclosed throughout Applicant's specification, but are not taught or suggested in Seanor.

Seanor discloses a heat exchanger having a metal drum with a plurality of longitudinally directed, circumferentially spaced holes which extend along the length of the heat exchanger (col. 2, lines 54-59). As shown in Fig. 1, heat exchange fluid flows through individual apertures 17 in the inner end plate and intermediate the outer end plate and adjacent inner end plate to a first end of two adjacent holes, for example holes 3a and 3b. The heat exchange fluid then flows through holes 3a and 3b, which extend along a length of the heat exchanger, and is exhausted from an

opposite end of each hole 3a and 3b. The heat exchange fluid flows through apertures 17 in a second inner end plate, into a dished end member 16, and exits the heat exchanger through a bore 13.

Seanor discloses a heat exchanger wherein the heat exchange fluid flows through discrete holes, such as holes 3a and 3b, which are circumferentially spaced about the inner end plate. Thus, the heat exchange fluid is not evenly distributed about the periphery of the drum and cannot provide uniform heat transfer.

Seanor does not disclose or suggest a thermal transfer roller having an outer shell, an inner shell and an annulus between the outer shell and the inner shell, as required by Applicants' invention as claimed in independent Claims 1, 14 and 20. Applicants' invention provides for a substantially even fluid discharge around the circumference of the annulus which can be maintained by minimizing the distance between adjacent channels approaching the annulus. As a result of the even fluid discharge around the circumference of the annulus, the outer shell provides uniform heat transfer and conduction to the substrate contacting the outer shell. Further, unlike Applicants' invention as claimed in independent Claims 1 and 14, Seanor does not disclose a roller journal which extends along a central axis of the heat exchanger to transfer heat transfer fluid from one end of the heat exchanger to the opposite end of the heat exchanger.

Applicants urge that the above Amendment and remarks overcome the rejection of Claims 1-4, 8, 9, 14 and 18-21 under 35 U.S.C. §102(b) as being anticipated by Seanor. Thus, Applicants respectfully request withdrawal of this rejection.

Claim Rejections - 35 U.S.C. §103

The rejection of Claims 5-7, 10-12, 15-17 and 22-25 under 35 U.S.C. §103 as being unpatentable over Seanor is respectfully traversed, particularly in view of the above Amendment and the following remarks.

Claims 5-7 and 10-12 ultimately depend from and further limit independent Claim 1, which Applicants believe is patentable for the reasons presented above. Claims 15-17 ultimately depend from and further limit independent Claim 14, which Applicants believe is patentable for the reasons presented above.

Claims 5-7, 10-12 and 15-17 recite 10, 20 and 30 channels in the embodiment of the respective independent Claim from which they depend. As set forth above, contrary to the Examiner's assertion, Seanor does not teach or suggest important claimed features of the present invention regardless of the claimed number of channels. Further, as explained on page 13, line 9-15, of the specification, the number of channels is important because if there are too few in number, then angular flow of fluid within individual channels may occur to an undesirable degree.

*As expected
results*

Claims 22 and 23 depend from and further limit independent Claim 20, which Applicants believe is patentable for the reasons presented above. Claims 24 and 25 depend from and further limit dependent Claim 21, which depends from and further limits Claim 20. Seanor does not teach or suggest important claimed features of the present invention as claimed in amended Claim 20 regardless of the number of rollers claimed in Claims 22, 23, 24 and 25.

Applicants urge that the above Amendment and remarks overcome the rejection of Claims 5-7, 10-12, 15-17 and 22-25 under 35 U.S.C. §103 as being unpatentable over Seanor. Thus, Applicants respectfully request withdrawal of this rejection.

The rejection of Claim 13 under 35 U.S.C. §103 as being unpatentable over Seanor in view of Eriksen et al., U.S. Patent 5,590,704, is respectfully traversed, particularly in view of the above Amendments and the following remarks.

Claim 13 depends from and further limits Claim 1, which Applicants believe is patentable for the reasons presented above. Eriksen et al. teaches a bent sheet with profiles in a helical pattern, such that fluid can flow through the ducts below the profiles and above the sheet through the annulus. It would not have been obvious at the time this invention was made to a person having ordinary skill in the art to employ in Seanor a spiral fluid flow channel for the purpose of reducing flow resistance as disclosed in Eriksen et al. Further, the two-way flow mechanism in

Eriksen et al. would not be a logical combination with Seanor to create the present invention, mainly because a combination of the teachings of Eriksen et al. with Seanor would result in a two-way flow mechanism wherein the fluid flows through spaced apart holes which extend along a length of the heat exchanger. In contrast, the present invention is directed to a one-way flow mechanism, one embodiment of which utilizes a spiral flow pattern to help maximize heat transfer by facilitating an even and high degree of fluid fill, and high fluid velocity within the annulus, as explained on page 14 of the present specification.

Applicants urge that the above remarks overcome the rejection of Claim 13 under 35 U.S.C. §103 as being unpatentable over Seanor in view of Eriksen et al. Thus, Applicants respectfully request withdrawal of this rejection.

Conclusion

Applicants intend to be fully responsive to the outstanding Office Action. If the Primary Examiner detects any issue which the Primary Examiner believes Applicants have not addressed in this response, Applicants urge the Primary Examiner to contact the undersigned.

Serial No.: 09/240,524

Docket No.: KCC-14,026-CPA

Applicants sincerely believe that this patent application is now in condition for allowance and, thus, respectfully request early allowance.

Respectfully submitted,

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